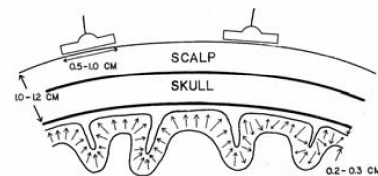
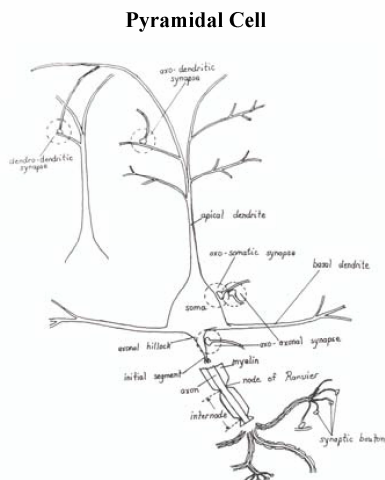


**Presentation 8 – Thomas Ferree**

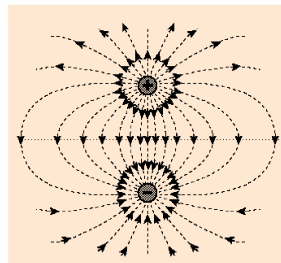
# EEG Program for Gulf War Research

Thomas Ferree, PhD  
*Department of Radiology  
UT Southwestern Medical Center*

## Cellular Sources of EEG

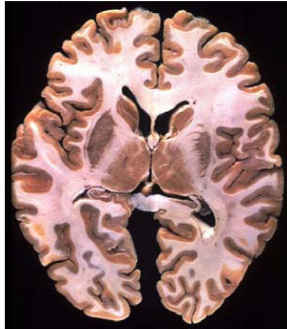


### Current Dipole



## Cortical Sources of EEG

### Cortical Sheet



### Axonal Fibers



## Added Value of EEG for Gulf War Research

### General

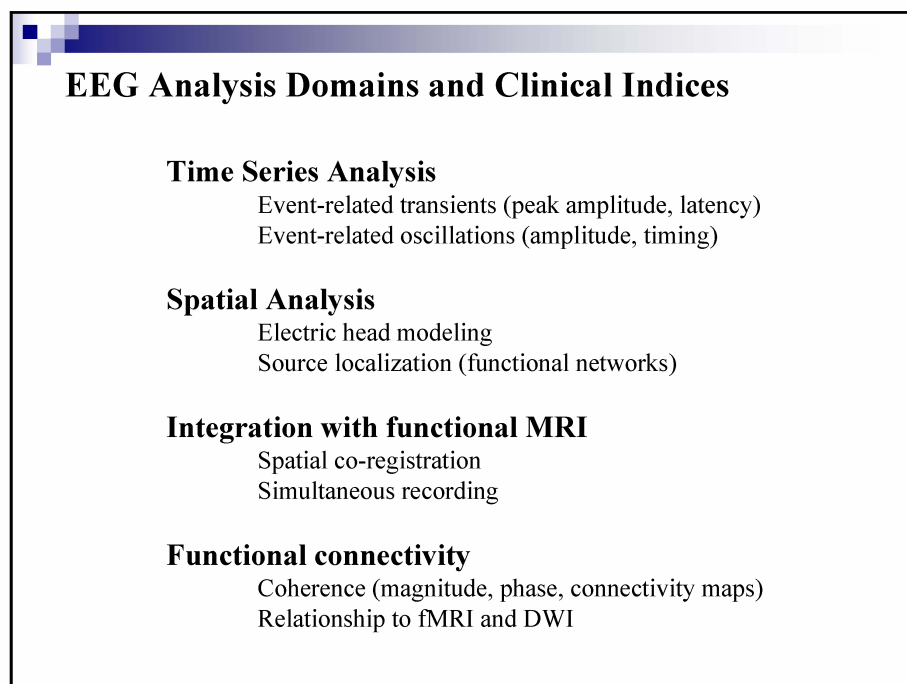
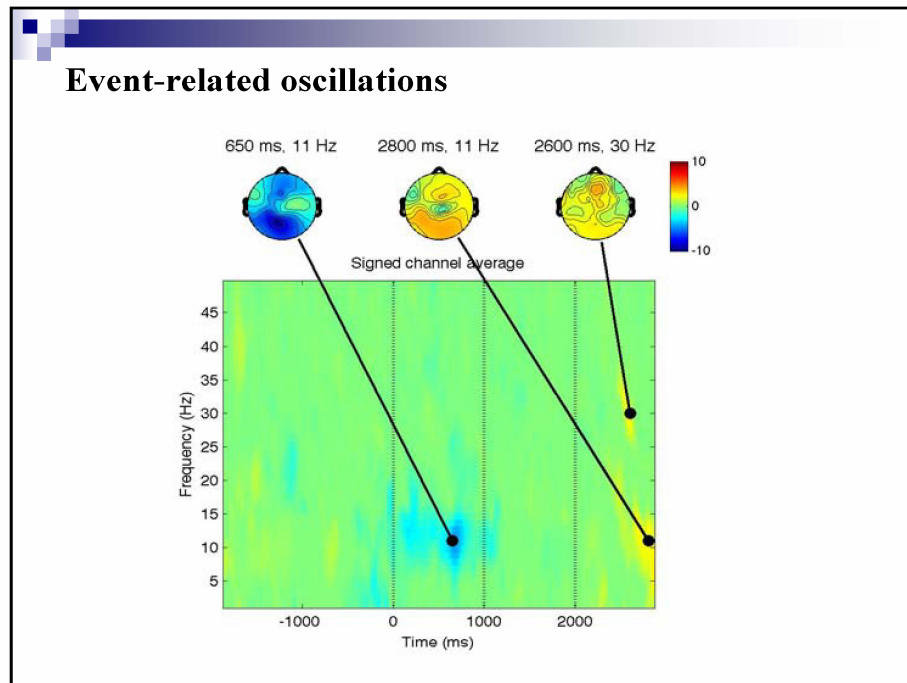
- Measure neural activity with millisecond timing
- Detect oscillations within and between brain areas
- Impairment within areas or communication between areas?

### Word-Word Binding

- Associate oscillations with cognitive processes
- Distinguish processes through their temporal ordering

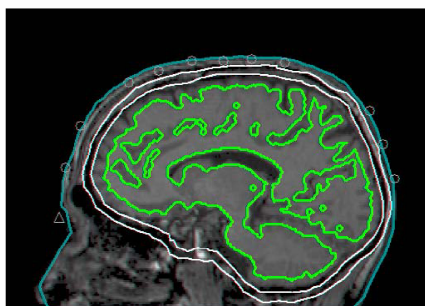
### Continuous Performance

- Ability to analyze continuously through time
- Power spectrum correlates with performance



## Electric Head Modeling: Two Components

### 1. Geometry



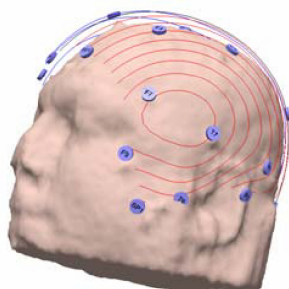
### 2. Conductivity

Tissue	Mean $\sigma$	Stdev $\sigma$
Brain	0.25	0.13
CSF	1.79	0.02
Skull	0.018	0.014
Scalp	0.44	0.2

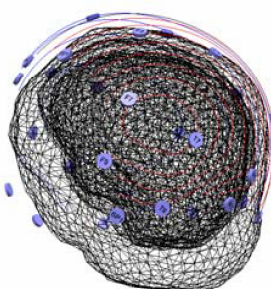
**Can measure conductivity  
non-invasively with EIT:  
(Electric Impedance Tomography)**

## Electric Source Localization

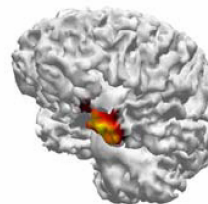
**Scalp  
Voltage  
Data**



**Electric  
Head  
Model**



**Brain  
Source  
Current**



## Simultaneous EEG and Functional MRI

### Motivations

- Best of both worlds: spatial and temporal resolution
- Match recording environment and stimulation parameters
- Match subject state, e.g., alertness, etc.
- Avoid training effects
- Convenience

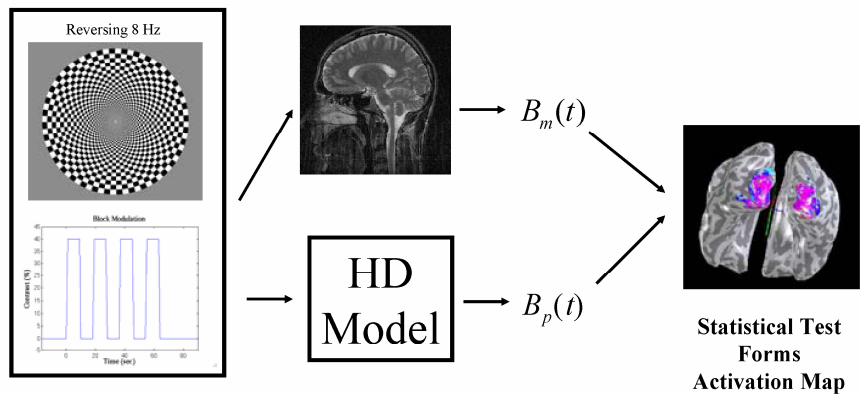
### Challenges

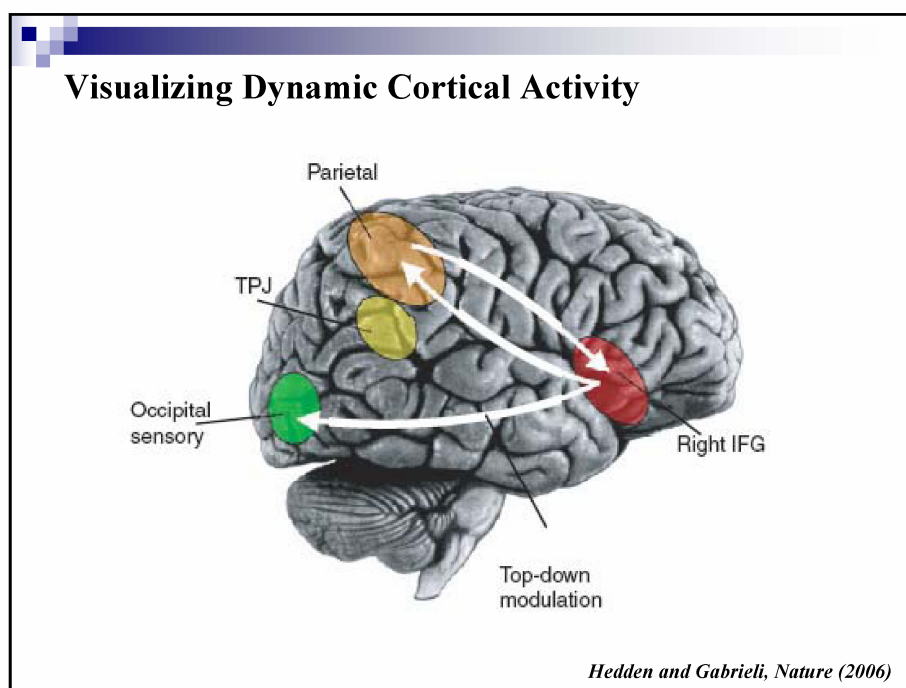
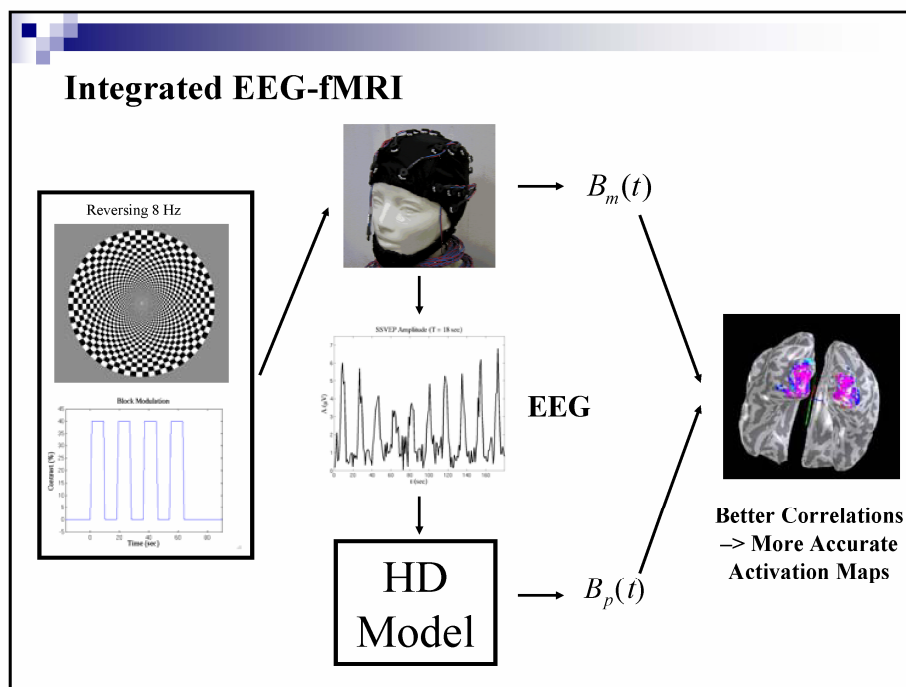
- Artifacts induced by MR magnetic fields
- Optimize cognitive paradigms for EEG and fMRI

### Larger Goals

- Clarify relationship between neural oscillations and fMRI maps
- Improved statistical tests for functional activation

## Standard MRI





## EEG Program Development

### Done

- IRB approval for EEG, EEG-fMRI
- Protocols for cap application, cleaning, etc.
- System integrity
- Data quality and artifact reduction
- EEG pilot studies in normal subjects
- Preliminary analyses of EEG data

### To Do

- Integrate EEG/EIT into full pilot studies
- Extend IRB approval to EIT
- Space renovations, booth installation
- Equipment upgrades, purchases
- New hires, training

## Main Collaborators

### UT Southwestern

Richard Briggs  
Priya Xavier  
Audrey Chang  
Aman Goyal  
Kaundinya Gopinath  
Mette Posamentier  
Pat Carmack  
Jeff Spence

### UT Dallas

John Hart  
Mandy Maguire  
Gail Tillman  
Cliff Calley  
Matt Brier  
Tim Green

### SMU

Wayne Woodward  
Henry Gray

**...More To Come**